



PCT/GB 2003 / 0 0 2 4 2 8
Rec'd PCTO 1 DEC 2004

INVESTOR IN PEOPLE

The Patent Office
Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ

#2

PRIORITY DOCUMENT

SUBMITTED OR TRANSMITTED IN
COMPLIANCE WITH RULE 17.1(a) OR (b)

REC'D 25 JUN 2003

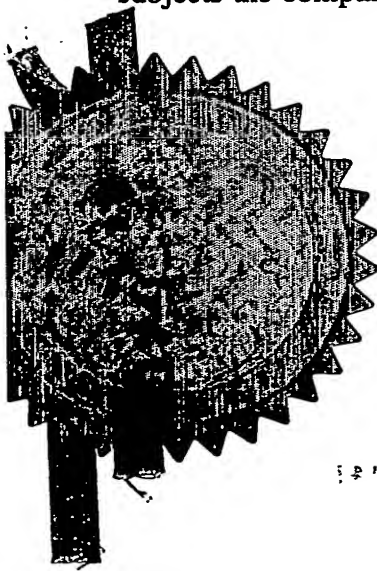
WIPO PCT

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

In accordance with the rules, the words "public limited company" may be replaced by p.l.c., plc, P.L.C. or PLC.

Re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.



Signed

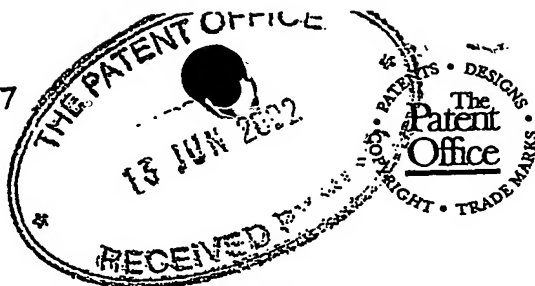
Stephen Hardy

Dated

26 March 2003

CERTIFIED COPY OF
PRIORITY DOCUMENT

BEST AVAILABLE COPY



14JUN02 E725760-3/002093
P01/7700 0.00-0213638.0

The Patent Office

Cardiff Road
Newport
South Wales
NP10 8QQ

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

1. Your reference

PPD 70067/GB/P

2. Patent application number

(The Patent Office will fill in this part)

0213638.0

3. Full name, address and postcode of the or of each applicant (underline all surnames)

SYNGENTA Limited
European Regional Centre
Priestley Road
Surrey Research Park, Guildford,
Surrey, GU2 7YH, United Kingdom

Patents ADP number (if you know it)

6254007002

8330748001

If the applicant is a corporate body, give the country/state of its incorporation

UNITED KINGDOM

4. Title of the invention

COMPOSITION

5. Name of your agent (if you have one)

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

Jane SWIFT
Intellectual Property Department
Syngenta Limited
Jealott's Hill International Research Centre
PO Box 3538
Bracknell, Berkshire, RG42 6YA
UNITED KINGDOM

Patents ADP number (if you know it)

802 9563001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number

Country

Priority application number
(if you know it)

Date of filing
(day / month / year)

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application

Date of filing
(day / month / year)

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:

- a) any applicant named in part 3 is not an inventor, or
 - b) there is an inventor who is not named as an applicant, or
 - c) any named applicant is a corporate body.
- See note (d))

YES (b)

Patents Form 1/77

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form 09

Description 03

Claim(s) 01

Abstract 01

Drawing(s) 00

10. If you are also filing any of the following, state how many against each item:

Priority documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (Patents Form 7/77)

Request for preliminary examination and search (Patents Form 9/77)

Request for substantive examination (Patents Form 10/77)

Any other documents (please specify)

11.

I/We request the grant of a patent on the basis of this application.
Syngenta Limited

Signature J A Bowdich
Authorised Signatory

Date 13/6/02

12. Name and daytime telephone number of person to contact in the United Kingdom

Julie Anne BOWDICH = 01344 414102

Warning

After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

Notes

- a) If you need help to fill in this form or you have any questions, please contact the Patent Office on 08459 500505.
- b) Write your answers in capital letters using black ink or you may type them.
- c) If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.
- d) If you have answered 'Yes' Patents Form 7/77 will need to be filed.
- e) Once you have filled in the form you must remember to sign and date it.
- f) For details of the fee and ways to pay please contact the Patent Office.

COMPOSITION

The present invention relates to a herbicidal composition, to its preparation and use.

The protection of crops from weeds and other vegetation that inhibits crop growth is a constantly recurring problem in agriculture. To help combat this problem, researchers in the field of synthetic chemistry have produced an extensive variety of chemicals and chemical formulations effective in the control of such unwanted growth. Chemical herbicides of many types have been disclosed in the literature and a large number are in commercial use. Commercial herbicides and some that are still in development are described in The Pesticide Manual, 12th edition, published in 2000 by the British Crop Protection Council.

Many herbicides also damage crop plants. The control of weeds in a growing crop therefore requires the use of so-called 'selective' herbicides which are chosen to kill the weeds while leaving the crop undamaged. Few selective herbicides are selective enough to kill all the weeds and leave the crop completely untouched. In practice, the use of most selective herbicides is actually a balance between applying enough herbicide to acceptably control most of the weeds whilst causing only minimal crop damage.

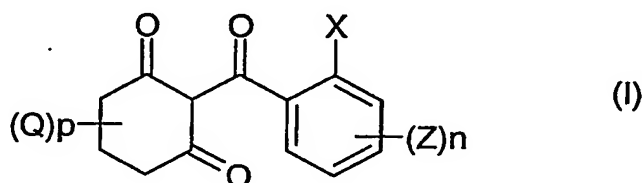
One important class of selective herbicides are 2-(substituted benzoyl)-1,3-cyclohexanedione compounds disclosed, *inter alia*, in United States Patent Nos. 4,780,127, 4,938,796, 5,006,158, and 5,089,046 the disclosures of which are incorporated herein by reference. A particularly preferred 2-(substituted benzoyl)-1,3-cyclohexanedione is mesotrione, chemical name 2-(2-nitro-4-methylsulfonylbenzoyl)-cyclohexanedione. This is known largely for use to selectively control weeds in a corn (maize) crop, both before the crop emerges from the ground (pre-emergent) and after (post-emergent).

Bis (2-ethylhexyl) 2-ethylhexyl phosphonate has been suggested for use as an agrochemical adjuvant. For example, US 2 927 014 discloses the use of a range of organic phosphonate and phosphinate compounds as herbicides. WO93/04585 discloses the use of certain organic phosphinate and phosphonate compounds as adjuvants to enhance the activity of certain herbicides. WO94/18837 teaches the use of a specific phosphonate, bis (2-ethyl hexyl) 2-ethylhexyl phosphonate, as adjuvant to improve the

bioperformance of specified of herbicides. In WO98/00021 there is disclosed that certain phosphonate or phosphinate compounds provide improved fungicidal activity in combination with certain fungicides such as fluquinconazole and azoxystrobin. However, the particular use of phosphonate and phosphinate in improving the efficacy and selectivity of 2-(substituted benzoyl)-1,3-cyclohexanedione compounds has not been disclosed, especially at low levels of addition of these compounds to a 2-(substituted benzoyl)-1,3-cyclohexanedione.

Accordingly, the present invention provides a herbicidal composition comprising:

- i) a 2-(substituted benzoyl)-1,3-cyclohexanedione of formula (I)



wherein X represents a halogen atom; a straight- or branched-chain alkyl or alkoxy group containing up to six carbon atoms which is optionally substituted by one or more groups $-OR^1$ or one or more halogen atoms; or a group selected from nitro, cyano, $-CO_2R^2$, $-S(O)_mR^1$, $-O(CH_2)_iOR^1$, $-COR^2$, $-NR^2R^3$, $-SO_2NR_2R^3$, $-CONR^2R^3$, $-CSNR^2R^3$ and $-OSO_2R_4$;

R^1 represents a straight- or branched-chain alkyl group containing up to six carbon atoms which is optionally substituted by one or more halogen atoms;

R^2 and R^3 each independently represents a hydrogen atom; or a straight- or branched-chain alkyl group containing up to six carbon atoms which is optionally substituted by one or more halogen atoms;

R^4 represents a straight- or branched-chain alkyl, alkenyl or alkynyl group containing up to six carbon atoms optionally substituted by one or more halogen atoms; or a cycloalkyl group containing from three to six carbon atoms;

each Z independently represents halo, nitro, cyano, $S(O)_mR^5$, $OS(O)_mR^5$, (C_1-C_6) -alkyl, (C_1-C_6) alkoxy, (C_1-C_6) haloalkyl, (C_1-C_6) haloalkoxy, carboxy, (C_1-C_6) -alkylcarbonyloxy, (C_1-C_6) alkoxycarbonyl, (C_1-C_6) alkylcarbonyl, amino, (C_1-C_6) -alkylamino, (C_1-C_6) dialkylamino having independently the stated number of carbon atoms in each alkyl group, (C_1-C_6) alkylcarbonylamino, (C_1-C_6) alkoxycarbonylamino,

(C₁-C₆)alkylaminocarbonylamino, (C₁-C₆)dialkylaminocarbonylamino having independently the stated number of carbon atoms in each alkyl group, (C₁-C₆)alkoxycarbonyloxy, (C₁-C₆)alkylaminocarbonyloxy, (C₁-C₆)dialkylcarbonyloxy, phenylcarbonyl, substituted phenylcarbonyl, phenylcarbonyloxy, substituted phenylcarbonyloxy, phenylcarbonylamino, substituted phenylcarbonylamino, phenoxy or substituted phenoxy;

R⁵ represents cyano, -COR⁶, -CO₂R⁶ or -S(O)_mR⁷;

R⁶ represents hydrogen or straight- or branched-chain alkyl group containing up to six carbon atoms;

10 R⁷ represents (C₁-C₆)alkyl, (C₁-C₆)haloalkyl, (C₁-C₆)cyanoalkyl, (C₃-C₈)cycloalkyl optionally substituted with halogen, cyano or (C₁-C₄)alkyl; or phenyl optionally substituted with one to three of the same or different halogen, nitro, cyano, (C₁-C₄)haloalkyl, (C₁-C₄)alkyl, (C₁-C₄)alkoxy or -S(O)_mR⁸;

R⁸ represents (C₁-C₄)alkyl;

15 each Q independently represents (C₁-C₄)alkyl or -CO₂R⁹ wherein R⁹ is (C₁-C₄)alkyl;

m is zero, one or two;

n is zero or an integer from one to four;

r is one, two or three; and

20 p is zero or an integer from one to six; and

ii) an organic phosphate, phosphonate or phosphinate adjuvant at a concentration of less than 0.5% v/v when added to a spray tank as a tank mix additive or when co-formulated with a herbicide to produce a spray tank concentration of less than 0.5% v/v.

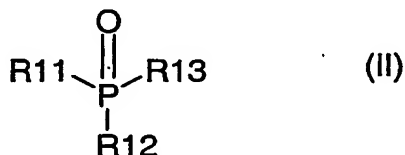
25 Suitably, X is chloro, bromo, nitro, cyano, C₁-C₄ alkyl, -CF₃, -S(O)_mR¹, or -OR¹; each Z is independently chloro, bromo, nitro, cyano, C₁-C₄ alkyl, -CF₃, -OR¹, -OS(O)_mR⁵ or -S(O)_mR⁵; n is one or two; and p is zero.

Preferably, the 2-(substituted benzoyl)-1,3-cyclohexanedione of formula (I) is selected from the group consisting of 2-(2'-nitro-4'-methylsulphonylbenzoyl)-1,3-cyclohexanedione, 2-(2'-nitro-4'-methylsulphonyloxybenzoyl)-1,3-cyclohexanedione, 2-

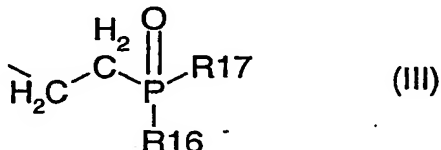
30

(2'-chloro-4'-methylsulphonylbenzoyl)-1,3-cyclohexanedione, 4,4-dimethyl-2-(4-methanesulphonyl-2-nitrobenzoyl)-1,3-cyclohexanedione, 2-(2-chloro-3-ethoxy-4-methanesulphonylbenzoyl)-5-methyl-1,3-cyclohexanedione and 2-(2-chloro-3-ethoxy-4-ethanesulphonylbenzoyl)-5-methyl-1,3-cyclohexanedione.

- 5 Suitably, the phosphate, phosphonate or phosphinate adjuvant is a compound of formula II



- wherein R^{11} is an alkoxy group containing from 4 to 20 carbon atoms or a group $-\text{[OCH}_2\text{CHR}^{14}]_t\text{-OR}^{15}$ wherein R^{14} is hydrogen, methyl or ethyl, t is from 0 to 50 and R^{15} is hydrogen or an alkyl group containing from 1 to 20 carbon atoms; and R^{12} and R^{13} are independently (i) an alkyl or alkenyl group containing from 4 to 20 carbon atoms; (ii) optionally substituted phenyl; (iii) an alkoxy group containing from 4 to 20 carbon atoms or (iv) a group $-\text{[OCH}_2\text{CHR}^{14}]_t\text{-OR}^{15}$ as herein defined; or (v) a group of formula (III)



- 15 wherein R^{16} is an alkoxy group containing from 4 to 20 carbon atoms or a group $-\text{[OCH}_2\text{CHR}^{14}]_t\text{-OR}^{15}$ as herein defined and R^{17} is an alkyl group containing from 4 to 20 carbon atoms, optionally substituted phenyl, an alkoxy group containing from 4 to 20 carbon atoms or a group $-\text{[OCH}_2\text{CHR}^{14}]_t\text{-OR}^{15}$ as herein defined; and wherein t is from 0 to ten.

- 20 The term "alkyl" as used herein, including when used in expressions such as "alkoxy", includes linear or branched chain alkyl groups. Optional substituents which may be present in optionally substituted phenyl include C_{1-4} alkyl and halogen.

- When all of R^{11} , R^{12} and R^{13} are alkoxy groups, the compound of formula (II) is an organic phosphate. When R^{11} and R^{12} are alkoxy groups and R^{13} is an alkyl, alkenyl or optionally substituted phenyl group, the compound of formula (II) is an organic phosphonate. When R^{11} is an alkoxy group and R^{12} and R^{13} are alkyl, alkenyl or optionally substituted phenyl groups, the compound of formula (II) is an organic phosphinate.

Optional alkoxylation of an ester group is represented by the group $-\text{[OCH}_2\text{CHR}^{14}]_t\text{-OR}^{15}$ as herein defined. It is preferred that the value of t is from 0 to 10 and more preferably from 0 to 5. If a range of degrees of alkoxylation is present, t may represent an average value and is not necessarily an integer. Similarly, mixed alkoxylation may take place such that different values of R^{14} are present in the group $-\text{[OCH}_2\text{CHR}^{14}]_t$. It is preferred that R^{15} is an alkyl group containing from 1 to 8 carbon atoms. If t is 0, the group $-\text{[OCH}_2\text{CHR}^{14}]_t\text{-OR}^{15}$ becomes alkoxy and when t is 0 therefore the group $-\text{OR}^{15}$ is suitably alkoxy containing from 4 to 20 carbon atoms.

When the compound of formula (II) is a phosphonate, it is preferred that each of the groups R^{11} and R^{12} are alkoxy groups containing from 4 to 10 carbon atoms and R^{13} is an alkyl group containing from 4 to 10 carbon atoms. Suitable phosphonates are disclosed in WO 98/00021 and the present invention also includes equivalents wherein the relevant alkyl chain length is lower than that disclosed in WO 98/00021. It is especially preferred that each of R^{11} , R^{12} and R^{13} contain from 4 to 8 carbon atoms. Preferred phosphonates are bis-(2-ethylhexyl)-2-ethylhexylphosphonate, bis-(2-ethylhexyl-octylphosphonate and bis-butyl-butylphosphonate.

When the compound of formula (II) is a phosphate it is preferred that each of the groups R^{11} , R^{12} and R^{13} are alkoxy groups containing from 4 to 10 carbon atoms. It is especially preferred that each of R^{11} , R^{12} and R^{13} contain from 4 to 8 carbon atoms. Preferred phosphates are tri-2-ethylhexylphosphate and tributyl phosphate.

When the compound of formula (II) is a phosphinate, it is preferred that R^{11} is an alkoxy group containing from 4 to 10 carbon atoms and R^{12} and R^{13} are both alkyl groups containing from 4 to 10 carbon atoms. It is especially preferred that each of R^{11} , R^{12} and R^{13} contain from 4 to 8 carbon atoms. Suitable phosphonates are disclosed in WO 98/00021 and the present invention also includes equivalents wherein the relevant alkyl chain length is lower than that disclosed in WO 98/00021.

Suitably, the concentration of phosphate, phosphonate or phosphinate in the spray composition is in the range 0.01% to 0.49 % and most preferably in the range 0.05% to 0.2%.

Herbicide compositions, such as those of the present invention are usually supplied as a concentrate which is diluted with, dissolved in or dispersed in water shortly before use. In the present invention, the concentrate generally comprises between 30 and

950g/litre of the 2-(substituted benzoyl)-1,3-cyclohexanedione of formula (I), preferably 100 to 800g/l., most preferably 150 to 500g/l. The phosphate, phosphonate or phosphinate adjuvant may, if desired, be added to the concentrate composition at a weight ratio of the herbicide to the phosphate, phosphonate or phosphinate of from 25:1 and 1:25 and especially 10:1 and 1:10 more especially 1:5 and 5:1. In addition, one or more further active ingredients, for example a second herbicide, may be added to the concentrate composition.

Alternatively, the phosphate, phosphonate or phosphinate adjuvant may be added to the spray tank (diluted) composition. Adjuvants are normally applied as a percentage of the spray volume applied per hectare. Water volume per hectare is normally about 200 litres/ha but can vary from 50 to greater than 3000 for special applications. Adjuvants are nominally applied at volumes of from 0.05% to 1.0% of the spray volume per hectare. Taking 200 l/ha as an average, typical volume rates of adjuvant will therefore be in the region of 100g (0.05%) to 2000g (1.0%). Typical herbicide rates range from 10g/ha to 1kg. Therefore one skilled in the art will expect ratios which cover these typical use rates for both active and adjuvant. These relate directly to ratio (by weight) of the compound of formula (I) to the compound of formula (II) from 50:1 to 1:400. It is preferred that the ratio by weight of the compound of formula (I) to the compound of formula (II) is from 25:1 and 1:25 and especially 10:1 and 1:10 more especially 1:5 and 5:1.

The herbicidal composition of the invention may thus be formulated as granules, as wettable powders, as suspension concentrates, as emulsifiable concentrates, as granular formulations, powders or dusts, as flowables, as solutions, as suspensions or emulsions. These formulations may contain as little as about 0.5% to as much as about 95% or more by weight of active ingredient. The optimum amount for any given compound will depend upon formulation, application equipment, and nature of the plants to be controlled.

Wettable powders are in the form of finely divided particles that disperse readily in water or other liquid carriers. The particles contain the active ingredient retained in a solid matrix. Typical solid matrices include fuller's earth, kaolin clays, silicas and other readily wet organic or inorganic solids. Wettable powders normally contain about 5% to about 95% of the active ingredient plus a small amount of wetting, dispersing, or emulsifying agent. If liquid compounds of Formula II are formulated as dry products

such as WP (or WG), there will be a requirement to absorb/adsorb these into/onto suitable carriers for this formulation type.

Suspension concentrates are high concentration suspensions of solid herbicide in a liquid carrier such as water or an oil.

5 Emulsifiable concentrates are homogeneous liquid compositions dispersible in water or other liquid, and may consist entirely of the active compound with a liquid or solid emulsifying agent, or may also contain a liquid carrier, such as xylene, heavy aromatic naphthas, isophorone and other non-volatile organic solvents. In use, these concentrates are dispersed in water or other liquid and normally applied as a spray to the
10 area to be treated. The amount of active ingredient may range from about 0.5% to about 95% of the concentrate.

Granular formulations include both extrudates and relatively coarse particles, and are usually applied without dilution to the area in which suppression of vegetation is desired. Typical carriers for granular formulations include sand, fuller's earth, attapulgite
15 clay, bentonite clays, montmorillonite clay, vermiculite, perlite and other organic or inorganic materials which absorb or which can be coated with the active compound. Granular formulations normally contain about 5% to about 25% active ingredients which may include surface-active agents such as heavy aromatic naphthas, kerosene and other petroleum fractions, or vegetable oils; and/or stickers such as dextrans, glue or synthetic
20 resins. Water emulsifiable granules can also be produced by appropriate means which are well know to those skilled in the art.

Dusts are free-flowing admixtures of the active ingredient with finely divided solids such as talc, clays, flours and other organic and inorganic solids that act as dispersants and carriers.

25 Formulations which are amenable to the production of mixed products are especially important since a compound of formula II will generally be an oil (or soluble in an organic solvent) and the 2-(substituted benzoyl)-1,3-cyclohexanedione derivatives of formula (I) will generally be highly insoluble in water and therefore most easily formulated as a dispersion in water (or an oil). Thus dispersions of multiple phases are
30 the likely formulations of choice.

Other useful formulations for herbicidal applications include simple solutions of the active ingredient in a solvent in which it is completely soluble at the desired concentration, such as acetone, alkylated naphthalenes, xylene and other organic solvents. Pressurized sprayers, wherein the active ingredient is dispersed in finely divided form as a result of vaporization of a low boiling dispersant solvent carrier, may also be used.

Many of these formulations include wetting, dispersing or emulsifying agents. Examples are alkyl and alkylaryl sulphonates and sulphates and their salts; polyhydric alcohols; polyethoxylated alcohols; esters and fatty amines. These agents, when used, normally comprise from 0.1% to 15% by weight of the formulation.

Another suitable additive is crop oil concentrate (COC) which is well known for herbicides and is a mixture of petroleum oils and non-ionic surfactants, available as, for example AGRI-DEX, PENETRATOR, and PENETRATOR PLUS and from Helena Chemical Company, HER-BIMAX from UAP, ES CROP OIL PLUS from Gromark, and CROP OIL PLUS, from Wilfarm, (83% paraffinic oil, 17% emulsifier surfactant). Other possible additives include urea ammonium nitrate, a fertiliser, methylated seed oil and ammonium sulphate.

Each of the above formulations can be prepared as a package containing the herbicide together with other ingredients of the formulation (other active ingredients, diluents, emulsifiers, surfactants, etc.). The formulations can also be prepared by a tank mix method, in which the ingredients are obtained separately and combined at the grower site.

The compositions of the present invention can be used to control the growth of weeds. Accordingly, a further aspect of the invention provides a process for the control of weeds, said process comprising applying a herbicidally effective amount of a composition according to the invention to the locus of the weeds.

The composition of the invention may be used against a large number of agronomically important weeds, including *Stellaria*, *Nasturtium*, *Agrostis*, *Digitaria*, *Avena*, *Setaria*, *Sinapis*, *Lolium*, *Solanum*, *Phaseolus*, *Echinochloa*, *Scirpus*, *Monochoria*, *Sagittaria*, *Bromus*, *Alopecurus*, *Sorghum halepense*, *Rottboellia*, *Cyperus*, *Abutilon*, *Sida*, *Xanthium*, *Amaranthus*, *Chenopodium*, *Ipomoea*, *Chrysanthemum*,

Galium, Viola, and Veronica. For purposes of the present invention, the term "weeds" includes undesirable crop species such as volunteer crops.

Controlling means killing, damaging, or inhibiting the growth of the weeds.

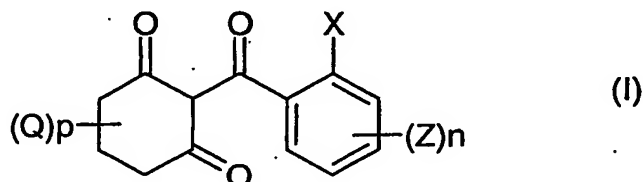
5 The "locus" is intended to include soil, seeds, and seedlings, as well as established vegetation.

The benefits of the present invention are seen most when the composition is applied to kill weeds in a growing crop, such as Maize (corn). The benefit of the invention is seen most with post-emergent application, but pre-emergent application is also possible.

CLAIMS

1. A herbicidal composition comprising:

(i) a 2-(substituted benzoyl)-1,3-cyclohexanedione of formula (I)



wherein X represents a halogen atom; a straight- or branched-chain alkyl or alkoxy group containing up to six carbon atoms which is optionally substituted by one or more groups $-OR^1$ or one or more halogen atoms; or a group selected from nitro, cyano, $-CO_2R^2$, $-S(O)_mR^1$, $-O(CH_2)_rOR^1$, $-COR^2$, $-NR^2R^3$, $-SO_2NR_2R^3$, $-CONR^2R^3$, $-CSNR^2R^3$ and $-OSO_2R_4$;

R^1 represents a straight- or branched-chain alkyl group containing up to six carbon atoms which is optionally substituted by one or more halogen atoms;

R^2 and R^3 each independently represents a hydrogen atom; or a straight- or branched-chain alkyl group containing up to six carbon atoms which is optionally substituted by one or more halogen atoms;

R^4 represents a straight- or branched-chain alkyl, alkenyl or alkynyl group containing up to six carbon atoms optionally substituted by one or more halogen atoms; or a cycloalkyl group containing from three to six carbon atoms;

each Z independently represents halo, nitro, cyano, $S(O)_mR^5$, $OS(O)_mR^5$, (C_1-C_6) -alkyl, (C_1-C_6) alkoxy, (C_1-C_6) haloalkyl, (C_1-C_6) haloalkoxy, carboxy, (C_1-C_6) -alkylcarbonyloxy, (C_1-C_6) alkoxycarbonyl, (C_1-C_6) alkylcarbonyl, amino, (C_1-C_6) -alkylamino, (C_1-C_6) dialkylamino having independently the stated number of carbon atoms in each alkyl group, (C_1-C_6) alkylcarbonylamino, (C_1-C_6) -alkoxycarbonylamino, (C_1-C_6) alkylaminocarbonylamino, (C_1-C_6) -dialkylaminocarbonylamino having independently the stated number of carbon atoms in each alkyl group, (C_1-C_6) alkoxycarbonyloxy, (C_1-C_6) -alkylaminocarbonyloxy, (C_1-C_6) dialkylcarbonyloxy, phenylcarbonyl, substituted phenylcarbonyl, phenylcarbonyloxy, substituted phenylcarbonyloxy,

phenylcarbonylamino, substituted phenylcarbonylamino, phenoxy or substituted phenoxy;

R^5 represents cyano, $-COR^6$, $-CO_2R^6$ or $-S(O)_mR^7$;

R^6 represents hydrogen or straight- or branched-chain alkyl group containing up to six carbon atoms;

R^7 represents (C_1-C_6) alkyl, (C_1-C_6) haloalkyl, (C_1-C_6) cyanoalkyl, (C_3-C_8) -cycloalkyl optionally substituted with halogen, cyano or (C_1-C_4) alkyl; or phenyl optionally substituted with one to three of the same or different halogen, nitro, cyano, (C_1-C_4) haloalkyl, (C_1-C_4) alkyl, (C_1-C_4) alkoxy or $-S(O)_mR^8$;

R^8 represents (C_1-C_4) alkyl;

each Q independently represents (C_1-C_4) alkyl or $-CO_2R^9$ wherein R^9 is (C_1-C_4) -alkyl;

m is zero, one or two;

n is zero or an integer from one to four;

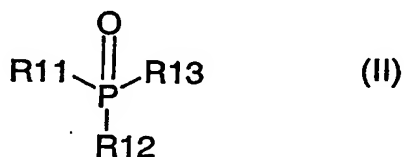
r is one, two or three; and

p is zero or an integer from one to six; and

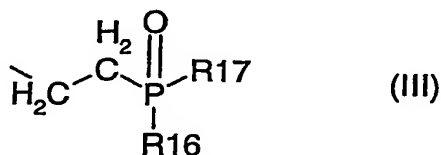
(ii) an organic phosphate, phosphonate or phosphinate adjuvant at a concentration of less than 0.5% v/v when added to a spray tank as a tank mix additive or when co-formulated with a herbicide to produce a spray tank concentration of less than 0.5% v/v.

2. A herbicidal composition according to claim 1, wherein X is chloro, bromo, nitro, cyano, C_1-C_4 alkyl, $-CF_3$, $-S(O)_mR^1$, or $-OR^1$.
3. A herbicidal composition according to any one or claims 1 or 2, wherein each Z is independently chloro, bromo, nitro, cyano, C_1-C_4 alkyl, $-CF_3$, $-OR^1$, $-OS(O)_mR^5$ or $-S(O)_mR^5$.
4. A herbicidal composition according to any one of claims 1 to 3, wherein n is one or two.
5. A herbicidal composition according to any one of claims 1 to 4, wherein p is zero.

6. A herbicidal composition according to any one of claims 1 to 5, wherein the compound of formula (I) is selected from the group consisting of 2-(2'-nitro-4'-methylsulphonylbenzoyl)-1,3-cyclohexanedione, 2-(2'-nitro-4'-methylsulphonyloxy benzoyl)-1,3-cyclohexanedione, 2-(2'-chloro-4'-methylsulphonylbenzoyl)-1,3-cyclohexanedione, 4,4-dimethyl-2-(4-methanesulphonyl-2-nitrobenzoyl)-1,3-cyclohexanedione, 2-(2-chloro-3-ethoxy-4-methanesulphonylbenzoyl)-5-methyl-1,3-cyclohexanedione and 2-(2-chloro-3-ethoxy-4-ethanesulphonylbenzoyl)-5-methyl-1,3-cyclohexanedione.
7. A herbicidal composition according to any one of claims 1 to 6, wherein the phosphate, phosphonate or phosphinate adjuvant is a compound of formula II



wherein R^{11} is an alkoxy group containing from 4 to 20 carbon atoms or a group $-\text{[OCH}_2\text{CHR}^{14}]_t\text{-OR}^{15}$ wherein R^{14} is hydrogen, methyl or ethyl, t is from 0 to 50 and R^{15} is hydrogen or an alkyl group containing from 1 to 20 carbon atoms; and R^{12} and R^{13} are independently (i) an alkyl or alkenyl group containing from 4 to 20 carbon atoms; (ii) optionally substituted phenyl; (iii) an alkoxy group containing from 4 to 20 carbon atoms or (iv) a group $-\text{[OCH}_2\text{CHR}^{14}]_t\text{-OR}^{15}$ as herein defined; or (v) a group of formula (III)



wherein R^{16} is an alkoxy group containing from 4 to 20 carbon atoms or a group $-\text{[OCH}_2\text{CHR}^{14}]_t\text{-OR}^{15}$ as herein defined and R^{17} is an alkyl group containing from 4 to 20 carbon atoms, optionally substituted phenyl, an alkoxy group containing from 4 to 20 carbon atoms or a group $-\text{[OCH}_2\text{CHR}^{14}]_t\text{-OR}^{15}$ as herein defined; and wherein t is from 0 to ten.

8. A process for the control of weeds, said process comprising applying a herbicidally effective amount of a composition according to the invention to the locus of the weeds.

ABSTRACT
COMPOSITION

5

A novel herbicidal composition comprising a 2-(substituted benzoyl)-1,3-cyclohexanedione and an organic phosphate, phosphonate or phosphinate adjuvant at a concentration of less than 0.5% v/v when added to a spray tank as a tank mix additive or when co-formulated with a herbicide to produce a spray tank concentration of less than

10 0.5% v/v is disclosed.



**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☒ **BLACK BORDERS**
- ☐ **IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- ☐ **FADED TEXT OR DRAWING**
- ☐ **BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- ☐ **SKEWED/SLANTED IMAGES**
- ☐ **COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- ☐ **GRAY SCALE DOCUMENTS**
- ☐ **LINES OR MARKS ON ORIGINAL DOCUMENT**
- ☐ **REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- ☐ **OTHER:** _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.